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An Inconvenient Thirst: A Look at the 2008-2009 Texas Drought

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An Inconvenient Thirst: A Look at the 2008-2009 Texas Drought

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The 2008-2009 Texas drought rivals the 1950s drought, known as the "drought of record," as one of the state's worst droughts in recent memory. Prolonged periods of little to no precipitation combined with high temperatures and the strain of population growth have created disastrous conditions especially across the southern and central regions of the state, which have been hardest and longest. At one point, more than 83 percent of the entire state was in some form of drought and the United States Department of Agriculture declared more than half the state as a primary natural disaster area due to losses from drought, above-normal temperatures and associated wildfires. More than $4 billion in agricultural losses have been predicted as a result of the drought. Even after heavy rains have lifted nearly all of Texas out of drought, there are still counties in extreme and exceptional drought. It is clear that water issues will continue to impact the state socially, economically and ecologically, so it is crucial for all Texans to have a better understanding of the myriad ramifications drought can have on various industries and communities throughout the state.

Table of Contents

In the past two years, nearly the entire state of Texas has been gripped by some level of drought. The central, southeast and coastal regions of the state have seen the worst drought they've had since the 1950s drought of record, which lasted about seven years. For many, this drought even far outweighs that drought in severity and records in temperature highs and precipitation lows have been broken. As of Nov. 4, the United States Department of Agriculture has declared nearly 55 percent of Texas as primary natural disaster areas due to losses from drought, above-normal temperatures and associated wildfires this year. Contiguous counties also qualified for natural disaster assistance because of their proximity to affected counties.

"I remember the drought in the '50s. This is much worse," recalls Charles Hunter, a rancher in Blanco County who has raised goats and sheep in the area for more than 50 years. "Even in the '50s we'd get good rain occasionally."

Still, even if drought conditions improve, as it is expected to this year due to the El Niño weather pattern, which brings Texas increased precipitation and lower temperatures, water conservation will still be an issue as populations continue to increase. Four major cities in Texas had the largest population growths in the country, according to the most recent U.S. Census report. Many have said that this drought has been harder to deal with compared to the 1950s drought simply because of greater populations creating a greater strain on water resources.

Hunter concurs with that assessment, saying that aside from the lack of precipitation, what has made the drought harder to cope with is the increased strain population growth has placed on the water table. "Then [in the 1950s], we didn't have subdivisions, the population, all the people, all the wells draining on the aquifer and that's what's made it so bad now…That to me is why this one is worse." Even during the drought of record, Hunter remembers not having

difficulties accessing his water from more than one spot, but this year, he lost water pressure if he ran more than one hose at a time.

While it's difficult to pin down whether patterns of drought will intensify in the future, as far as precipitation levels, global warming will certainly have a profound effect on the local climate and exacerbate the state's already dry and hot weather, according to Texas state climatologist John Nielsen-Gammon.

However, many fail to recognize the impact that drought can have on our state socially, economically and ecologically so it is vital for all Texans to have a better understanding of how a drought can affect various communities and industries throughout the state.

In just two years, repeated days of dry weather and intense heat have wreaked havoc on the state. According to Nielsen-Gammon, the 2008 to 2009 Texas Drought first appeared in north-central and northeast regions of the state in late November 2007 and reached southern Texas, where the drought has been most intense, January 2008, reaching its apex in June 2008 when more than 83 percent of the entire state was in some form of drought.

The core-drought area was located in south-central Texas and after two months of rain and tropical moisture from hurricanes Dolly and Ike, much of the drought was eliminated, except for in this core area. Instead, south-central Texas experienced a concentration of drought as the months wore on and remained in extreme drought, the second worst drought category used by the U.S. Drought Monitor. The Monitor decides drought categories based on several drought indexes and models and extreme drought is marked by major crop and pasture losses as well as widespread water shortages or restrictions.

Drought conditions failed to improve during the succeeding fall and winter, which not only received below-average precipitation, but the period between December 2008 to February 2009 were the driest in recorded history (dating back to 1895). Nearly 80 percent of the state again found itself in drought by early April, though severity intensified in the core-drought area.

This core area also experienced record-breaking or near record-breaking heat. By mid-July nearly a quarter of the state was ranked in the two worst drought categories, with nearly 18 percent in exceptional drought, the U.S. Drought Monitor's worst drought ranking. Exceptional drought is marked by widespread crop and pasture losses and water shortages in reservoirs, streams and wells that can create water emergencies.

By late August, extreme or exceptional drought plagued nearly one third of the state, all concentrated in south-central and southern Texas, and at least nine counties experienced the worst conditions since modern record-keeping started in 1985. Data through that August indicated that it was the driest 24 months on record in San Antonio and it suffered at least 57 days of more than 100 degrees, when typically it's closer to 12 days. Meanwhile, nearly all of the northern half of the state had finally rid itself of drought.

Texas communities get their water through either surface water from lakes and reservoirs or through groundwater, which collects in underground aquifers. In parts of Central Texas, including Travis County, surface water is managed by the Lower Colorado River Authority, which is in charge of the entire water supply of the lower Colorado River basin. Lake Travis and Lake Buchanan are the two major reservoirs along the Colorado River and collectively they provide drinking water and irrigation for more than one million people.

Despite heavy rains in September and October, lake levels have barely increased since the ground is so dry the majority of rainfall soaks into the parched soil, rather than becoming run

off that ends up in lakes and other bodies of water. To put it in perspective, water levels in Lake Travis were so low that vehicles abandoned at the bottom emerged. At its lowest, Lake Travis was more than 50 feet below full and recent rains, which have greened up the area and have downgraded the area out of the two worst levels of drought, the lakes remain low. Currently, Lake Travis is 21 feet below average and Lake Buchanan is nearly 18 feet below average and combined, the lakes are at 51 percent of capacity.

Despite minor increases in lake levels, this heavy rainfall has relieved much of Texas of severe drought, with only about 21 percent facing drought conditions now. Extreme and exceptional drought has fallen to just over 6 percent.

"It's a huge turnaround for us to get some rain, even though it was too late for 2009," said Dr. Mark Welch, AgriLife Extension grains marketing economist. "We have enough growing season left that [the rain is] going to help grow grass, pastures and hay cutting. So there is some benefit primarily on the livestock and forage sector. It was just too late for crops."

Although the recent rains are largely a good sign for the general region, this improvement provides little comfort for those communities that are still listed under the two worst drought categories. These counties currently include Kleberg, Nueces, San Patricio, Jim Wells, Zavala, Uvalde and Real.

"The drought will end not with a bang but with a whimper," Nielsen-Gammon said. "It has already ended in some places, such as Bell County, while it shows no sigh of letting up near Kingsville [located in Kleberg County]."

The majority of water used in Texas is set aside for agriculture and as a result, our state's farmers and ranchers tend to get some negative backlash from thirsty urbanites.

Living in an urban area, it may be difficult to grasp the devastation drought can cause our rural neighbors. Sure, perhaps in the city once immaculately green lawns turn crisp due to withering heat and mandatory water restrictions; or now at restaurants, patrons are forced to request water instead of simply having it poured upon seating and perpetually refilled throughout the meal; or water sports are curtailed because boat slips have been closed or the water is simply too low or nonexistent to make water recreation possible. These effects don't tend to threaten one's quality of life (rarely does water stop flowing from one's taps altogether) or livelihood (unless, of course, one makes a living renting kayaks). For those working in agriculture, however, water is truly life sustaining. Water hydrates crops or land used for grazing livestock. Without it, farmers and ranchers lose those crops, their livestock, and ultimately, their livelihood and even way of life.

Drought has a myriad of effects that range from ecological to economical. The most obvious effect to most people is that without water, plants die, and arguably no Texas county has been more acutely aware of this fact than Kleberg County—home of the famous King Ranch, which bases its whole cotton crop here. This drought has caused the county to lose the entirety of its cotton harvest for the first time in more than a hundred years. Generally, the area averages about 28 inches of rain per year, but between September 2008 and August 2009, it received less than five inches. Texas is the largest cotton producer in the country and Kleberg usually contributes between 30 thousand to 40 thousand acres.

"The entire cotton acreage was zeroed out," said John Ford, an AgriLife Extension county agent for agriculture based in Kingsville, in an AgriLife press release.

Statewide, the U.S. Department of Agriculture reported that one-third of Texas cotton acreage ranked very poor or poor. Ford added that grain sorghum, another important crop in the area, fared slightly better and farmers were able to harvest three thousand acres out of 40 thousand acres.

Welch noted that a loss in cotton production can be particularly devastating because it is a high-input crop. A lot of money goes into growing and processing a cotton crop.

“Any time there’s a dramatic drop off in production of a crop that’s a major contributing economic factor in a region, there’s some dramatic consequences,” Welch said by telephone. “If you were to lose that part of what you’re doing for a while, that would be a significant drop off in economic activity.”

As a result, the county has lost an estimated $50 million. This deficit includes not only revenue from the crops themselves, but also money that would have been spent for motels that housed harvesting crews and labor costs for gins and grain elevators, among other factors. Welch also added that replacing cotton with another crop that may fare better in drought conditions, such as grain sorghum, wouldn’t completely fill the financial cavern left by a zeroed-out cotton harvest since sorghum is much cheaper to produce, harvest and process.

“Drought is kind of a slow situation,” said Dr. Carl Anderson, AgriLife Extension economist and professor emeritus. “It certainly puts some people out of business immediately. Then it sets another large group back financially and it takes years to recover.”

Overall, the losses that Kleberg County is estimated to suffer pales in comparison to that of the state overall. Currently, it is predicted that agricultural losses due to drought in Texas, the

country's second largest agricultural producer, are at $3.6 billion and will easily climb to more than $4 billion by the end of the year.

"Those producers who are facing two tough years in a row are really struggling," Welch said, specifically mentioning corn crops. "It's hard to know right now what degree of financial difficulty that they'll face in 2010," Welch said.

"The worst part of the crops were in the Coastal Bend where they lost at least 90 percent of total crop production and other places were far below average," Anderson said. He also said that aside from cotton and sorghum, corn production was also greatly impacted.

Welch said that what was especially hard on corn growers was that they lost their crops after already putting in a lot of the upfront costs. "The harder drought effects come for those who spend a lot of money in the beginning, only to lose it at the end," he said.

The USDA ranked more than 40 percent of corn and sorghum production statewide in the poor category. The drought also took a toll on hay production, which devastated livestock owners who were also subjected to limited forage production and grazing. "The drought impact was probably most severe on the livestock side of agriculture," Anderson said. Usually, livestock can graze for free or on hay that ranchers grow themselves. With the drought, most hay producers weren't able to produce any viable hay and instead ranchers had to purchase supplemental feed, which Anderson estimates to be around $2.50 a day per animal.

According to Dr. David Anderson, an AgriLife Extension livestock marketing economist, 40 percent of the state's cow herds and 6 percent of the nation's beef cow herd, are located in counties in extreme or exceptional drought. "The high cost of buying hay and supplemental feed is resulting in liquidation of some herds," he said in an AgriLife press release. Ranchers are not

only culling their herds, they're also being forced to sell calves at lighter weights so they don't make as much profit off a single head as they could in previous years.

Anderson also said that the total losses for Texas livestock is $869 million, which does not include reduced revenues from selling calves earlier and the loss in breeding stock. In addition to beef cattle, the loss for goats, honey, horses and sheep totals $105 million. In early July it was estimated that honey bottlers have seen a 75 percent decrease in production due to dried up water and pollen sources for bee colonies. This decline is especially devastating because of the large losses beekeepers have already experienced as a result of Colony Collapse Disorder.

These dry conditions caused Charles Hunter to sell a lot of his goats and sheep, which he raises for meat. Over the years, he's gone from running about 500 heads of these animals to now only 80 heads. Hunter said it wouldn't be unheard of for him and other ranchers to have to sell the rest of them soon should drought conditions continue or worsen. "A lot of people just sold out 'cause that's all they could do. You have no choice," Hunter said.

Hunter is also concerned that the drought could be the nail in the coffin for a lot of smaller farmers and ranchers. "Agriculture is in a very, very sad state. It's just nearly impossible to make a living in agriculture today," he said. Now, he said, profitable farms tend to be owned by large corporations. "There's no place for the little man," Hunter laments.

Hunter was able to depend on agriculture for his sole source of income at one point, but that was about 25 years ago. He then had to supplement his family's income by selling firewood and his wife also started working at Texas State University-San Marcos. He has also sold a lot of the land he inherited from his father to make ends meet. What was once close to one thousand acres purchased in 1938, has now dwindled to 340 acres. Hunter admits that even in his father's

day, agriculture had to be supplemented with other income. “It’s been that way for a very long time, but I think back then you could come a lot closer to making a living,” he said.

Significant crop loss has caused many in agriculture to apply for government relief, but Hunter said the funds take about a year to reach farmers and ranchers in need, whereas in the past, getting money was immediate. “We’re supposed to have help from our wonderful government and we’re waiting right now for [financial relief applied for in 2008] and now it’s 2009. By the time you get paid, you’re long gone,” Hunter said. “It takes forever and that stings.”

Dan Copeland of Sweet Berry Farm in Marble Falls was able to irrigate his crops using water extracted from an aquifer rather than rely solely on rainfall, a farming method known as dryland farming.

“We learned a long time ago not to farm anything we can’t irrigate,” Copeland said in an e-mail. “Dryland farming is very risky and will always bankrupt you. In our area it is not wise to count on timely rains in any year.” Copeland said that the area where they were hurt the most was with their goats due to the lack of grazing land. Like many who raise livestock, they were also forced to supplement feed, which affected their profits.

According to Mark Welch, irrigated farming isn’t an option for everyone because of both cost and feasibility. Many areas simply don’t have access to groundwater, such as that found in aquifers. In the Panhandle, irrigation is common because the area sits over a large aquifer with very clean water with few restrictions that limit its usage. However, the depth of aquifer water can be a limiting factor due to the cost of pumping, which also uses a lot of energy. “Other areas draw on aquifers that have a higher salt content, so you can use it for supplemental water, but you can’t replace rainfall,” Welch said. Rainfall is still needed to periodically leach salts left on these crops.

Even if one does have access to a strong aquifer, irrigating crops may not be a high priority when this water source also needs to be used for daily living.

Jill Hunter, daughter-in-law of Charles Hunter, lives on adjacent property with her husband, Doak. Together, the couple runs Texas Lavender Hills, which they do not depend on as their sole source of income and which Jill describes as a boutique farm. In years past, they grew their lavender only with rainwater, but the drought eventually forced them to supplement their fields by irrigating with water from their well. As the drought persisted, however, the couple, who have two young sons, had to reconsider their water priorities.

"With the drought, you don't want to be pumping water to the lavender because then we won't have water for our home," Jill said. "It wasn't that we had to keep the lavender alive. We had to keep water for ourselves, too." Instead, she just had to watch many of her plants die a "slow, progressive death." She said that it was particularly disheartening because it takes lavender plants two to three years to flower and it was many of their older plants that died. It will be at least a couple of years before their lavender recovers from this drought.

Another issue for growers who depend on irrigated water may not even be their priorities for water use but someone else's.

Welch is concerned that agriculture may not have the support it needs to hang on to water resources. "We'll see competing uses of water battling for limited water resources where we do use a lot of irrigation water for agriculture and then weigh that against what cities demand."

In the case of the LCRA, agricultural irrigation falls under interruptible water, meaning their water needs can be cut in order to satisfy the water demands of firm users, such as for municipal, domestic, industrial and steam-electrical power uses. The LCRA and rice farmers have

had a long history together and rice farmers have always depended on the river authority to provide them with the water they need.

However, should drought conditions continue unabated and the combined storage of lakes Travis and Buchanan remain below the 1.1 million acre-feet trigger (which may be raised even higher in future LCRA water plans), the LCRA intends to completely and immediately halt water from going downstream to interruptible water users, such as rice farmers, until conditions improve. Three hundred and fifty agricultural customers, mainly rice farmers, get irrigation water from the LCRA via an 1,100-mile canal system in Colorado, Matagorda and Wharton counties.

"Any curtailment of irrigation would impact our rice farmers and our economy and it's a pretty substantial part of our economy," said Brent Bachelor, Matagorda Extension county agent in a telephone interview. Bachelor estimates that 70 percent of rice farmers in the three potentially affected counties depend on water from the LCRA and not having that source of water would devastate those growers. "We're not prepared to supplement that much with groundwater through wells so they would just have to not farm and hopefully it won't come to that," he said.

According to AgriLife Extension estimates, rice production and milling contributed an average of $355 million in total annual output between 2005 and 2008 to the three rice producing counties that would be affected by an LCRA irrigation interruption.

Rice farmers also have few other options as far as switching to a less water-dependant crop, such as grain sorghum, because land that is suitable for growing rice—shallow soil over a layer of clay that helps hold in water—isn't suitable for much else. Grazing tends to be the only other viable option for this land, but rice farmers already rotate their land for this purpose. Bachelor also added that the equipment used in rice agriculture is highly specialized so that even

if a rice farmer's land was suitable for row crops, he or she wouldn't have the necessary equipment and purchasing this equipment may be prohibitively expensive.

Bachelor mentioned that there has been research partially funded by the LCRA for more rice varieties that use less water, but until they find it, rice farmers will just have to make do.

"I foresee, unless there's enough rain, that until we get a more regular inflow and rainfall pattern, there's a likelihood that we'll get some curtailment," Bachelor said. "Hopefully we'll be able to soften the blow. Everyone will give up some of their farm, percentage wise, but only the good Lord and Mother Nature will know if we get enough water."

The potential plight of rice farmers clearly illustrates the tension and complexity surrounding water allocation and resources management in the entire state, which is ultimately mandated by the Texas Commission on Environmental Quality. The commission has the final approval on regional water plans and is the arbiter of allocation disputes. The LCRA is just one of at least 11 regional water planning groups.

In his book *Water in Texas: An Introduction*, Andrew Sansom, a conservationist and the executive director of Texas State University's River Systems Institute, wrote that 60 percent of all water use in Texas is allocated toward irrigation, but by 2060, water set aside for irrigation will decline to 40 percent as booming urban areas and industries vie for more of this life-sustaining fluid.

To many outside of the community of rice farmers facing irrigation curtailment, the thought of cutting water to these growers would be a welcomed way to conserve water. After all, rice farmers consume the largest amount of LCRA water. Because of their uninterrupted supply of water, rice farmers fared quite well during the drought—dry conditions are actually better for

irrigated crops, Bachelor said, because fewer pests and diseases occur—while other water users were forced to reduce their water use.

However, AgriLife Extension estimates that about 2,590 jobs are created through rice agriculture. To larger economies, such as that of Travis County, this amount of job loss would be a drop in the bucket, just .5 percent of the entire labor market there. However, in Colorado, Matagorda and Wharton counties, this figure amounts to a potential 5 percent job loss their combined labor markets, according to data from the Labor Market and Career Information Department of the Texas Workforce Commission. Losing rice agriculture could potentially cause 10 times the damage (or proportionally more than 28,000 jobs in Travis County) to those economies dependent on rice farming.

Bachelor said that he and rice farmers understand the need for the LCRA to conserve water, but they're concerned that they would be left out of the discussion. Farmers "just want to feel like they have a space at the table," Bachelor said.

"They've always been part of the negotiations during all the changes in rates and the original water management plan. This time, the LCRA staff presented information on this new proposal on that Thursday before the board meeting and it was a drastic change for farmer to have to adjust to," Bachelor said. "Thankfully the board agreed to postpone [a decision] until the November meeting."

Regardless of the LCRA's final decision, the fact remains that populations will continue to increase while the amount of clean water available will likely remain the same, if not occasionally decrease due to periodic droughts and the effects of global warming.

Continued population growth ensures that, according to Sansom, without drastic changes to water management strategies "Texas does not have enough developed freshwater supply to meets its future projected needs." He wrote that the 2007 State Water Plan estimates a projected water supply shortage of 8.8 million acre-feet by 2060.

Four cities in Texas were in the 2008 U.S. Census's list of top ten metro-areas for population growth. Dallas-Fort Worth-Arlington topped the list, followed by Houston-Sugerland-Bay Town (No. 4), Austin-Round Rock (No. 8) and San Antonio (No. 10). Austin-Round Rock also ranks fifth in the top fastest-growing metro areas, seeing a 4.3 percent increase from July 2006 to July 2007.

"We're all dependent on the same sources [of water] and as there get to be more of us in Texas, more people, drought will have a greater effect on all of us," David Anderson said. "Not just farmers and ranchers. It's easy for someone to become complacent but [water reserves] may not always be there."

A recent study conducted by Columbia University climate experts found that the severe water shortages during the 2005 to 2007 drought in the Southeast was not caused by the severity of the drought, which was no worse than a previous drought, or effect from climate change.

"At the root of the water supply problem in the Southeast is a growing population," the researches wrote in their study.

Part of the issue with water allocation and management is the measuring stick water management organizations use. For example, the LCRA's plan uses the drought of record as the basis for all of its water resource planning, which determines the trigger points of when and how much users need to restrict water use and when water is cut off from interruptible clients.

A Guadalupe-Blanco River Authority report asserted that even using the drought of record as the standard for water planning is flawed. Citing a tree-ring study to compare the 1950s drought to other historic droughts, the GBRA stated in a press release that "there may have been periods when drought was more protracted and the impact might have been considerably worse."

The report concluded that "It would appear unwise for civil authorities to assume that the 1950s drought represents the worst case scenario to be used for planning purposes in water resources management in the South Central and Edwards Plateau climate divisions of Texas."

Considering this information, it is even more troubling that some water systems, such as the San Antonio Water System, didn't even use the drought of record for water planning, but a less intense drought during the 1980s, considered to not even be one of the top 20 short-term or long-term drought events. Although the San Antonio water resource plan was recently updated to use the "worst case" drought of record to determine water planning, it previously used the '80s drought because it was the "most likely" scenario.

San Antonio's lack of foresight and conservatism in water planning may be one of the reasons it's suing the LCRA for allegedly reneging on a water-sharing agreement between the two authorities. The LCRA maintains that the agreement would only move forward if the LCRA determined it had enough water to share and based on it's projections, it didn't.

"At a time when Colorado water user, like those in Austin, are taking unprecedented steps to cut back their use in response to extreme drought, it is perplexing that San Antonio officials are claiming that they are entitled to water from the Colorado River," said LCRA General Manager Tom Mason in a press release. "The study results show there isn't enough water to meet requirements for both regions."

And not only is the battle over water between water associations or firm-water users versus interruptible users, it's also between the needs of man and the needs of ecology.

In his book, Sansom adds that the Texas Water Plan only accounts for water necessary for human needs and does not address the water levels needed to maintain rivers, bays, and estuaries which sustain the health of the area's plants and animals. Even today, the drought has greatly impacted the state's natural flora and fauna and the value of recreational land, wherein humans enjoy the bounties of Mother Nature.

Should the LCRA curtail irrigation to rice farmers, Matagorda Bay will also be affected. Ducks Unlimited, a waterfowl conservation group, fears that Matagorda pintails, which depend on rice fields for winter foraging, will be affected.

"Without the availability of canal water, our conservation programs are severly hamstrung, and rice production, the breadbasket of food and habitat for waterfowl, is also lost," said Ducks Unlimited manager of conservation programs Todd Merendino in a press release. "This loss of rice production will wipe out 20 years of conservation efforts by [Ducks Unlimited], private landowners, [the Texas Prairie Wetlands Project], [the U.S. Fish and Wildlife Service], [USDA Natural Resource Conservation Service] and our many other partners."

Even without the hand of man determining where water goes, the drought itself has hurt wildlife habitats for countless animals and plants. The drought can also make bodies of water oxygen depleted, which can kill marine life.

"One important consequence is less water in the rivers, so less water flowing into the bays and estuaries along the Texas coast," Nielsen-Gammon said. "This affects the salinity and turbidity of the water and can have major impacts on those ecosystems."

In a drought report, Nielsen-Gammon also noted that alligators, forced out of habitats, were being discovered in water sources closer to developed areas and there were reports of an increase in snake bites as these reptiles were also forced to venture closer to humans for hydration. The endangered Barton Springs Salamander also risked being put back at the brink of extinction. The drought caused countless of trees to die, many of them hundreds of years old. And just as lack of forage hurt cow herds, the drought also took away food for other herbivores, such as deer and armadillos.

The state also suffered economic hardships as a result of natural habitats withering in the summer's dry, hot weather. AgriLife estimates that nearly $100 million have already been lost in revenue for land-based recreation, such as hunting, birding, camping and hiking. This figure does not take into account the loss of revenue from aquatic recreation, such as boating, which has certainly taken a huge hit since every one of the 12 boat ramps in Lake Travis have been closed since August.

Another byproduct of drought is increased risks of wildfires, which also have economic ramifications. In April 2009, more than 45 thousand acres were destroyed in Montague County, which resulted in $10 million worth of damages to fences and also the loss of hay, which were already decreased due to drought alone. At least 56 wildfires were also reported in South Texas from September 2009 to May 2009, even though burn bans were in effect since the beginning of the year.

Thankfully, the rest of the year is estimated to have unseasonably high precipitation levels and cooler temperatures due to the onset of El Niño in the region. However, it is still unclear whether this year's El Niño will be strong enough to make up for the epic losses in water Texas has accrued these past two years.

"So far, the official forecasts call for a weak to moderate El Niño, and I haven't seen any evidence going against that forecast," Nielsen-Gammon said. "We can't know for sure, but at this point anything other than weak to moderate seems very unlikely. The stronger El Niño is, the greater the expected effect on wintertime temperatures and rainfall in Texas."

The state climatologist described the likelihood of the drought ending. "According to researchers at the Climate Prediction Center, past El Niño events of similar magnitude produced precipitation well about normal six times, near normal twice, and well before normal twice. So since we have a rainfall deficit to make up, the odds are about eight in 10 that conditions will improve and about six in 10 that most of the drought will be eradicated," Nielsen-Gammon said, adding, "The Coastal Bend area still has a long way to go, though."

Regarding the long-term drought forecast in Texas, Nielsen-Gammon said it is possible that although the current drought could be part of the beginning of a long-term decline in rainfall, it is also likely precipitation will remain steady or even increase. However, though climate change may not adversely affect rainfall levels in the state, it has contributed to the drought's severity via increased temperatures.

"It seems reasonable to assume that present temperatures in Texas are on average about one degree Fahrenheit warmer than they would have been in the absence of global warming," Nielsen-Gammon wrote in his drought assessment. Increased temperatures mean increased evaporation rates and increased demands by thirsty livestock and humans.

"I can't say with much certainty whether precipitation amounts will rise or fall in the future," he said. "On the other hand, global warming will certainly cause expected temperatures to rise across Texas. This will increase potential evaporation rates and increase water demand by

plants and by customers. Plus, population is rising. So, it seems very likely that we will experience drier conditions with more water shortages and water restrictions than at present."

As a result, it is more important than ever to increase conservation efforts. Though epic droughts are certainly not welcome, one of its benefits over less severe droughts is its ability to at least raise awareness about the urgency of water conservation.

According to the Texas Agricultural Extension Service, the state's urban areas use about 25 percent of the water supply for landscape and garden watering, which is mostly used to maintain landscapes that are traditionally high water-demanding, such as lawns. The service states that most lawns are watered twice as much as required for a healthy appearance. This water is also often applied inefficiently and switching to a more efficient system, such as drip irrigation, can save 30 to 50 percent on one's water bill.

Therefore, it is imperative that Texans practice xeriscaping and using native plants in their landscape instead of trying to maintain thirsty lawns. Rainwater harvesting is another conservation effort that is gaining momentum as a result of the ongoing drought.

Recently, Billy Kniffen, an AgriLife Extension Service rainwater harvesting expert and member of the Texas Rainwater Catchment Association, has seen an increase in his association's membership from 200 members to more than 700 in the past two years. His extension has also constructed about 1,000 rain barrels this year, mainly in South Texas.

"The drought has woke many up, but it has helped all of Texas realize the impact population growth and drought will have on our water supply," Kniffen said. "Drought speeds concern, but the feeling is universal on the water shortage and water quality issue."

Kniffen, who lives in Menard County, and his wife have used rainwater harvesting and tight water conservation within their home so that they subsist entirely on rainwater. “I can live in the house for a year without rainfall,” he said. “We live off of less than five inches of rain a year inside our house.”

He stated that about 5,000 people in Texas live completely off rainwater. However, these are households that are not on a municipal water supply, so it is not possible for those in urban areas to live completely off the water grid. By state law, municipal water users can only use rainwater for nonpotable uses because of the danger that hooking up a rainwater line to the city line will cause it to back up during floods. Still, using harvested water for landscaping alone will save the average homeowner a quarter of their total water use.

Many local newspapers have declared that the drought is nearly over and several municipalities have rolled back water restrictions, though drought and water availability will continue to be an issue for all of Texans, whether they realize it or not.

“People can care if they want to,” Nielsen-Gammon concludes. “I think it’s important for people to have the mindset that they are the collective stewards of our water resources, because that’s what they are.”

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Reporting Techniques

In investigating my subject I researched news articles, press releases, various water plans, and looked at other Internet resources. I conducted telephone and e-mail interviews with those familiar with the subject matter. Please see list of resources below for more detailed information.

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